

On Prospects of Studying Mining and Mining Geology at VŠB – Technical University of Ostrava

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Abstract: In connection with a new role of mineral resources in the period of post-industrial society and with regard to the gradual decreasing of production, especially of coal, ores and uranium leading even to the closure of many mining plants in the Czech Republic after 1990, the Faculty of Mining and Geology of VŠB – Technical University of Ostrava (henceforth referred to as VŠB-TUO), similarly to other mining universities in the world, undergoes dynamic development. This trend is characterised by a transition from the prior orientation to the mineral complex to problems connected with the environmental and safety issues, more qualified utilisation of raw materials and their recycling, the utilisation of underground spaces, rehabilitation of the landscape, informatisation, and others. The contribution presents these changes in more detail.

Key words: Phase-out, mining, engineering study, models.

The base of the economy of each industrialized country is formed by mineral raw materials that stand at the very beginning of the manufacturing process. With the increasing role of high technologies, a share of raw and only little revaluated mineral raw materials is on the decrease in the all-society GDP in manufacturing countries.

The present developmental era of society can be characterised as post-industrial society. It means that the society has already overcome the period of industrial expansion, when the main evaluative criteria were, e.g. iron and cement productions, and others. This post-industrial society is necessary to be considered as the period of development of high technologies, of which are typical the utilisation of new materials, new saving technologies, information technologies and the keeping of principles of sustainable development. In spite of this, at the turn of the 21st century a problem appears facing geologists and mining experts. The problem concerns the quantity, quality and the duration of mineral resources available for human society. We give a more detailed discussion on and answers to these issues in the other contribution where also the role of mineral raw materials in the future is dealt with.

The Czech Republic is a country exploiting its mineral raw materials intensively for a long time. This exploitation has to be finished, especially for economical, technical and environmental reasons. After the year 1990, when the state gradually ceased to subsidize the mining of mineral raw materials, a significant reduction of production occurred and often even the phase-out of the whole districts. The exploitation of hard coal in the Ostrava part of the Ostrava-Karviná District and in the Western Bohemian, Eastern Bohemian and Rosice Districts died out totally and the overall annual production diminished to a half in comparison with the state before the year 1989. A similar drop can be seen in the production of brown coal; ore extraction being stopped wholly. The exploitation of uranium deposits is being brought to an end; certain development can be found with the extraction of industrial minerals.

The Czech brown and hard coal mining in the year 2000 is accompanied by ambiguities over the quantities of production, especially for demands of our power engineering. The question how many million tons are to be mined is replaced by the question what amounts of worked out coal will be possible to be sold. Therefore it is evident that merely economical mines and quarries with secured sales have got the chance of survival. Moreover, other reasons for declining the production of coal exist in the Czech Republic, specifically of brown coal. For instance, it is the case of decreased interest in coal as a power source in homes, heating plants and industries caused by the advancing gas distribution and partly by a transition to other, more eco-friendly kinds of energy. Recent drops in the industrial production and the production in prefabrication plants, the limitation of coal export possibilities

represent then other negative influences. However, in the long-term time horizon, the Czech power-producing industry will have to secure the energy production in coal-burning plants roughly on the present level, i.e. 60% of the total production of electrical energy. This assumption should correspond to the development in coal productions of about 40 million tons per year.

In January 2000 the government approved the energy national policy for next 30 years. This policy presupposes the definite end of coal mining in the Czech Republic in the period after the year 2030. However, reserves of hard and brown coal in the amount of about 2 milliard tons will remain underground. In addition to coal, the energy policy takes into account nuclear sources for energy production. A share of gas supplied from abroad should increase from present 19% to 25%. Besides, a role of renewable resources should be strengthened. Their part in the total energy production should be raised from present 1.5% to 8% in the year 2020.

The main problem of the phase-out in mining can be seen in the social sphere. The closure and restriction of mining plants have been connected with high unemployment that, at present, affects our largest areas of brown and hard coal mining.

The attenuation of mining activity then introduces many serious problems that have direct impacts on the environment, the social and economic spheres of society. Their inconsistent solving is always of a long-term character. Among other matters, the following necessities appear for this reason:

- the solving of hydrogeological aspects of mines under phase-out,
- studying the stability conditions in the areas with fading impacts of mining activity,
- solving the problems of the subsidence basin in the course of phase-out of production,
- the modelling of physical events in rocks and soils related to the course of phase-out operations,
- the solving of problems of forming and protecting the landscape affected by mining activity in connection with the transfer of vast bulks of materials,
- the settlement of problems of dynamic events at moving the rocks into spaces produced by exploitation,
- the solving of safety risks connected with the ascent of mine gases (especially methane, CO₂, radon, etc.) from undermined underground to the earth surface, especially in built-up areas with reference to the health and safety of people and property,
- the rational utilisation of mine spaces, quarries and drilling operations,
- the creation and completion of the integrated safety system in areas affected by the exploitation of mineral raw materials,
- the solving of removal and prevention of damage to the environment,
- the design of methods and technologies for the monitoring of changes in the environment,
- the solving of reclaiming the industrial landscape,
- the determination of the extent of environmental contamination induced by mining activity (solid, liquid and gas deposits),
- the economic complete analyses of the phase-out process with the aim to minimize impacts on the social sphere.

In spite of the above-mentioned tasks linked with the phase-out programmes in our mining, it is necessary to emphasize that mineral raw materials will remain required in the economy of the Czech Republic in the future as well. The degree of their needful will depend primarily on the structure of the Czech industry. It will not be possible to utilise ore raw materials from our own resources because of their mine-technical and economic parameters. To a certain extent, we shall utilise our own resources of hard and brown coal and a very various spectrum of industrial minerals, whose reserves are in the Czech Republic, minimally at the European scale, significant. The next development of the Czech mining and also, in a certain degree, mining geology will result from this situation.

Our higher education has accommodated to this situation too. At the Faculty of Mining and Geology of VŠB – TUO that, as the only university in the Czech Republic, educates professionals in the exploitation of useful raw materials, the teaching having been specialized earlier was concentrated on the two fields of study: *Mining Engineering* and *Exploitation and Treatment of Building Mineral Raw Materials*. However, a students' interest in mining has declined so that the number of graduates of these fields of study is lower than the need of present practice. High schools orientated to mining have almost disappeared.

Taking into account the complete view of newly arisen demands in the sector of **mining**, we think that, from the standpoint of education of new specialists, the following will be necessary:

- To secure the sufficient number of experts for functions of lower technical grades,
- To secure the sufficient number of graduates of mining fields of study, i.e. the fields of study *Mining Engineering* and *Exploitation and Treatment of Building Mineral Raw Materials*. The Faculty is prepared for the increase in the number of students of these fields; what should be done is to motivate students to such study in a suitable way,
- The present shortage in the senior technical staff in our mining plants is to be solved by retraining study completed by the defence of the assigned final thesis,
- In connection with the present shortage in graduate mining specialists in mining plants, it is necessary to bear in mind also the fact that they will be needful also in areas where mining activity has been already finished. It will be the case of a wide spectrum of special works related to the liquidation of old mining loads and with the redevelopment and reclamation of mining landscapes. Such activity will be requisite even several tens of years after the end of exploitation.

With reference to the above-mentioned changes in priorities in the area of mining activity, it will be essential to modify adequately also the model of education of a future engineer in the field of mining at the university. The structure of the study programme should contain the following five fundamental branches:

1. Common science and engineering foundations
2. Subjects of the studied field and, in the needful degree, also fields related
3. Economic, legal, social-philosophical and cultural-historical subjects
4. Environmental disciplines
5. System and information disciplines.

Then, what is meant is a transition from the education of, to a certain extent, a one-sided erudite specialist to a specialist who is characterised by considerable universality, comprehensiveness of the view on the problem under solving and rather great adaptability to changing conditions in the area of mining activity home and abroad as well. The Faculty of Mining and Geology of VŠB – TUO subsequently includes these changes into the syllabuses.

Mining Geology is a comprehensive field orientated technically that, in a needful degree, covers all areas of geological research and exploration activity. Professional training is directed especially towards the education of a geologist to whom the science, technical and economic base enables a rapid professional adaptation in relative and interdisciplinary fields. As far as the theoretical and practical spheres of teaching are concerned, the engineer is engaged in executing, organizing and evaluating all types of geological works. The analysis of economic issues connected with geological and following technical activity, evaluation of ecological aspects of geological, mining and industrial activity passes through the whole study. The graduate is simultaneously prepared to direct, organise and evaluate economically all the works related to geological service with applications of computer art. Special attention is paid to applied informatics in the common and special conception.

Practical field works, field trips and practical experience through which students will manage the procedure and execution of geological, geochemical, geophysical and other technical works, form an integral part of study. At the same time, the students will acquire knowledge of geological mapping and geological documentation management.

The basic courses are followed with professional shaping enabled by the choice of appropriate optional subjects. Students are offered recommended compositions of optional subjects resting upon expected developmental trends and demands in the national economy, namely in the fields as follows:

Geological informatics and geostatistics,
Hydrogeological and engineering-geological exploration,
Drilling and geophysical investigation.

In the world and also home, mining geology profiled like that is closely related to mining activity, whose analysis in the Czech Republic is presented in the previous part of the contribution.

Lately, but also in the future, geological activity in all advanced countries is orientated to securing other mineral resources (in the continents and also on the sea floors in the close causal nexus with new exploration and exploitation technologies) as well as, in the growing degree, to predicting so-called natural

anomalous events, such as earthquakes, volcanism, rock bursts, slides, and others and to effects induced by anthropogenic activity.

The content and activity of geological service are considerably concentrated on finding ecological loads represented by contaminations connected with mining, processing and manufacturing activity.

In addition, attention is called to interrelations between dynamics of the lithosphere and phenomena in the hydrosphere and atmosphere.

Modern geological instrumental techniques and methods are successfully applied to analyses of contaminated soils. Their results are utilised for the needs of land planning and agricultural purposes too.

Thus it can be rightfully stated that mining geology has become, under the conditions of the Czech Republic, in despite of its designation, a universal branch of science that, if curricula are suitably structured, ensures its graduates many employment possibilities in contrast with fields of purely university character. To fulfil this, it is necessary to adapt also gradually the model of study. The future graduate of the field of Mining Geology who should adapt himself sufficiently to rapidly changing working, technical, economic and other conditions, must have not only a broad science foundation, but also technological erudition and also ability to acquire “unprofessional” skills, such as enhanced legal conscience, economic knowledge, teamwork ability, foundations of managerial work, ethics foundations, language knowledge, etc.

Many foreign universities have arrived at similar results in the field of study Mining Geology. Montanuniversität Leoben, Bergakademie Freiberg, Colorado School of Mines, AGH Krakow, Ecole des Mines de Paris, Technische Universität Aachen, Donetsk National University and Faculty BERG in Košice can be ranked among them.

There are curricula redesigned for the accomplishment of the presented goals. The curricula in the field of mining geology are just being prepared at the Faculty of Mining and Geology of VŠB – TUO.